

## C4225 Log Data Report

### Borehole Information:

<b>Borehole:</b> C4225		<b>Site:</b> 216-U-12 Crib			
<b>Coordinates</b> (WA State Plane)		<b>GWL (ft)<sup>1</sup>:</b> Dry	<b>GWL Date:</b> 01/26/2004		
<b>North</b> Not Available	<b>East</b> Not Available	<b>Drill Date</b> Jan. 2004	<b>TOC<sup>2</sup> Elevation</b> Not Available	<b>Total Depth (ft)</b> 50	<b>Type</b> Push Hole

### Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	1.4	6 5/8	5 5/8	1/2	1.4	50
The logging engineer measured a sample of casing located in a lay-down area next to the borehole. Outside casing diameter was measured using a caliper. The measurements were rounded to the nearest 1/16 in.						

### Borehole Notes:

This push-hole is located at the 12 o'clock position about 19 ft north of the 216-U-12 Crib boundary. On the ground surface, there is a 0.5-ft-deep depression surrounding the borehole where the drill rig's mast stood. Zero reference is the ground surface.

### Logging Equipment Information:

<b>Logging System:</b> Gamma 1E	<b>Type:</b> SGLS (70%) 34TP40587A
<b>Calibration Date:</b> 01/2004	<b>Calibration Reference:</b> GJO-2004-568-TAC
<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0	

### Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 / Repeat	3		
Date	01/26/03	01/27/03	01/27/03		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	48.0	15.0	9.0		
Finish Depth (ft)	9.0	10.0	1.0		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A <sup>3</sup>	N/A	N/A		
Pre-Verification	AE068CAB	AE071CAB	AE071CAB		
Start File	AE070000	AE071000	AE071006		
Finish File	AE070039	AE071005	AE071014		

Log Run	1	2 / Repeat	3		
Post-Verification	AE070CAA	AE074CAA	AE074CAA		
Depth Return Error (in.)	0	N/A	0		
Comments	No fine-gain adjustment.	Repeat section	No fine-gain adjustment.		

### **Logging Operation Notes:**

Zero reference was ground surface. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT ( $^{40}\text{K}$ ,  $^{238}\text{U}$ , and  $^{232}\text{Th}$ ) verifier with serial number 118. Logging started at the nearest 0.5-ft interval after reaching total depth. Maximum logging depth achieved was 48.0 ft.

### **Analysis Notes:**

<b>Analyst:</b>	Sobczyk	<b>Date:</b>	1/28/04	<b>Reference:</b>	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 9.1 percent lower and 2.7 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EJan04.xls). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 6-in. casing with a thickness of 1/2 in. to 48.0 ft (total logging depth). The dead time correction is applied when the dead time exceeds 10 percent. A water correction was not required.

### **Log Plot Notes:**

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides ( $^{40}\text{K}$ ,  $^{238}\text{U}$ , and  $^{232}\text{Th}$ ), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The  $^{214}\text{Bi}$  peak at 1764 keV was used to determine the naturally occurring  $^{238}\text{U}$  concentrations on the combination plot rather than the  $^{214}\text{Bi}$  peak at 609 keV because it exhibited slightly higher net counts per second.

### **Results and Interpretations:**

$^{137}\text{Cs}$  was the only man-made radionuclide detected in this borehole.  $^{137}\text{Cs}$  was detected in the interval between 9 and 21 ft with concentrations ranging from 0.3 to 76 pCi/g. The maximum concentration was measured at 10 ft.  $^{137}\text{Cs}$  was also detected at 29 and 41 ft at concentrations near the MDL (0.2 pCi/g). Examination of the gamma energy spectra indicates that the occurrence of  $^{137}\text{Cs}$  at 29 ft is probably a statistical fluke, since a well-defined 662-keV photopeak is not evident. At 41 ft, a well-defined photopeak is evident at 662 keV, indicating that  $^{137}\text{Cs}$  exists at that depth.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV and for  $^{137}\text{Cs}$  at 662 keV.

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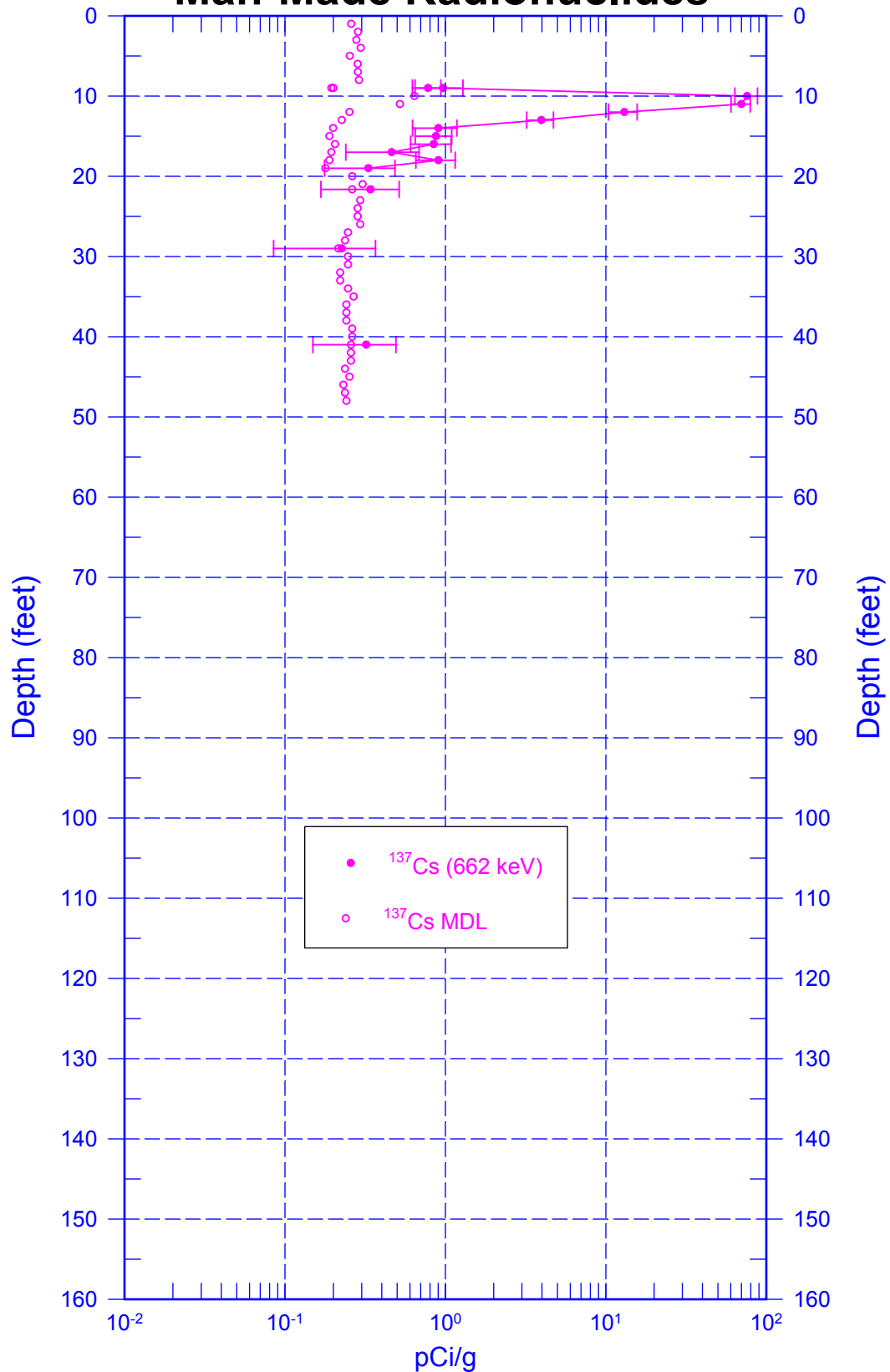
<sup>1</sup> GWL – groundwater level

<sup>2</sup> TOC – top of casing

<sup>3</sup> N/A – not applicable

# C4225

## Man-Made Radionuclides

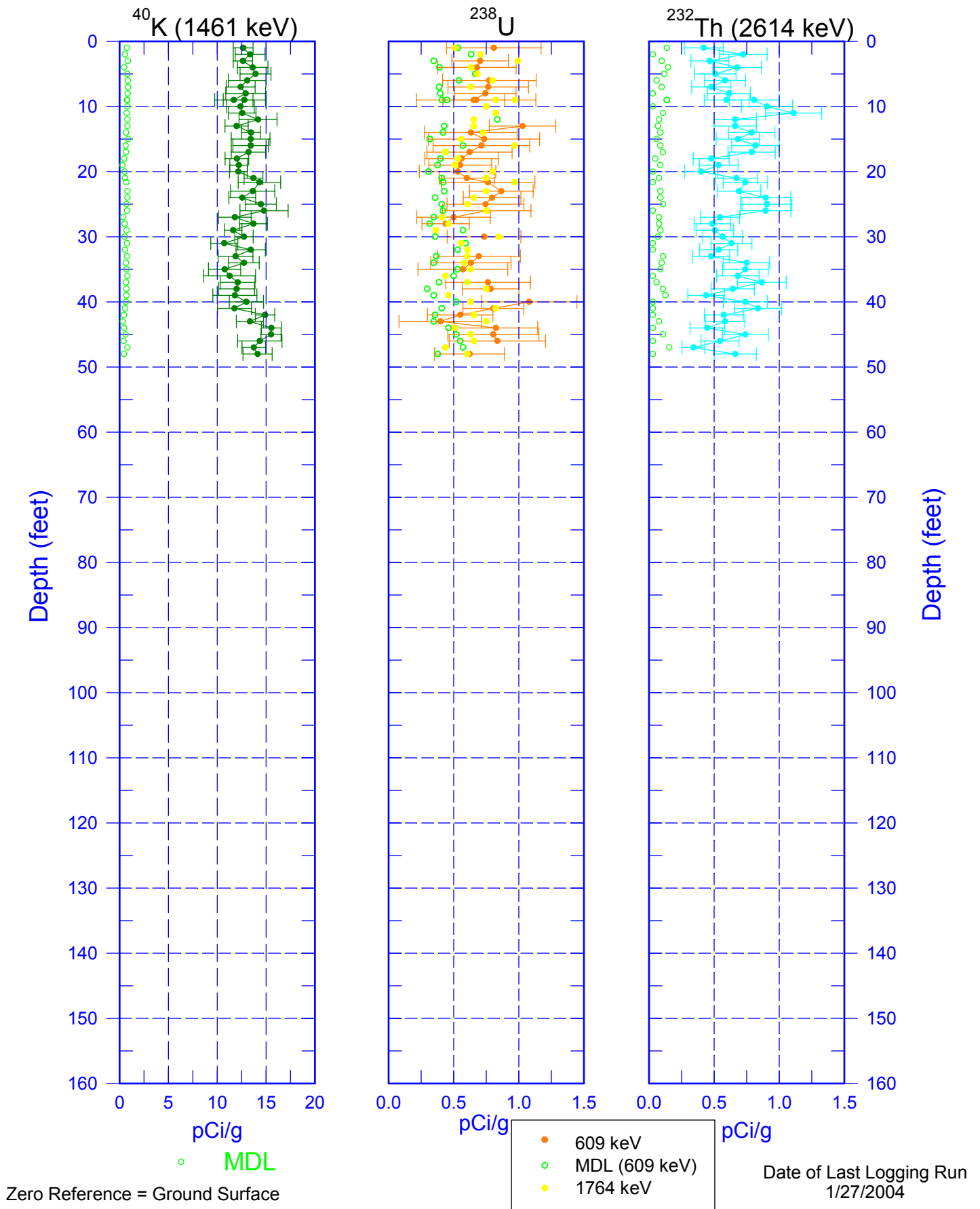


Zero Reference = Ground Surface

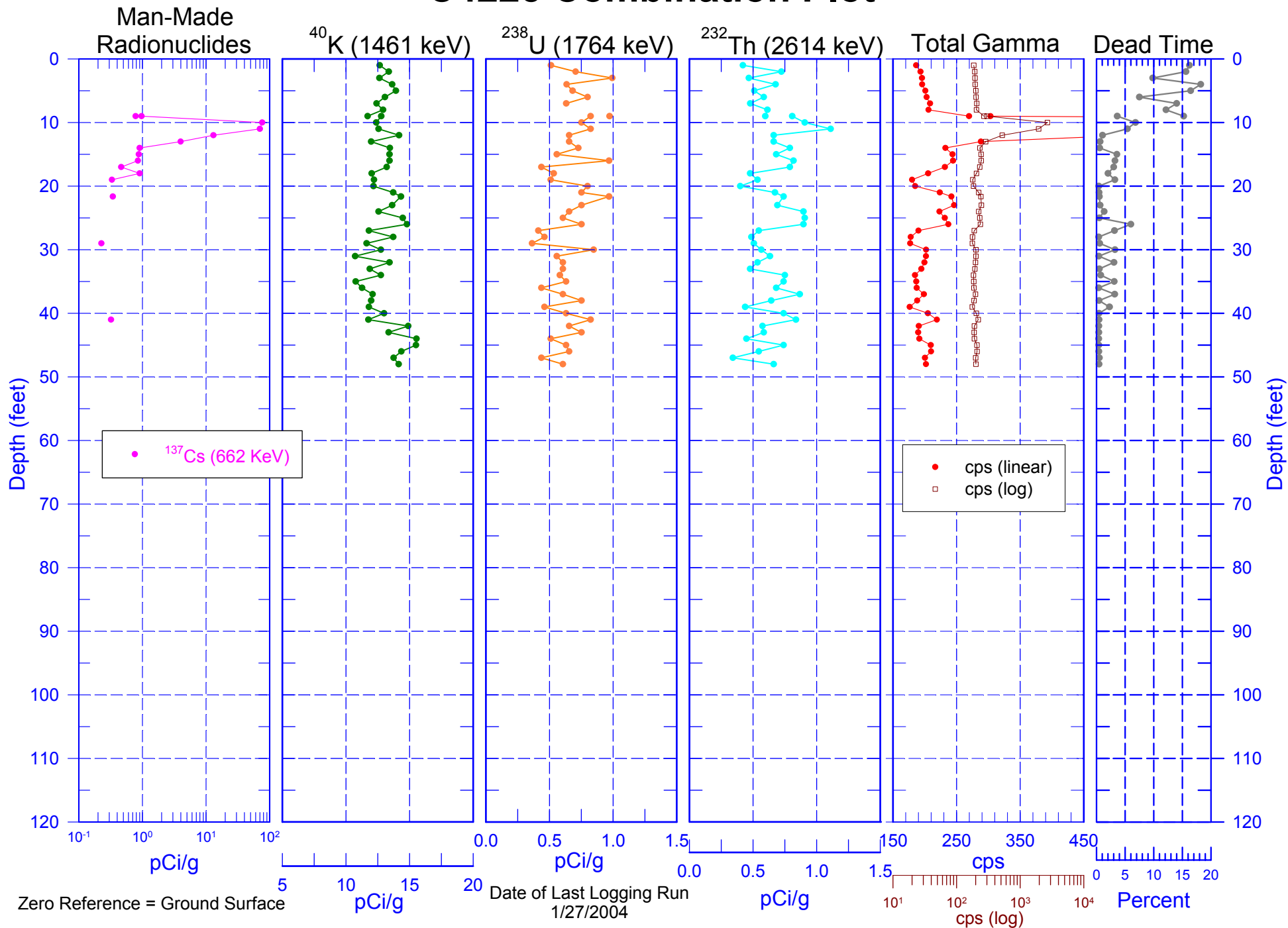
Date of Last Logging Run  
1/27/2004

# C4225

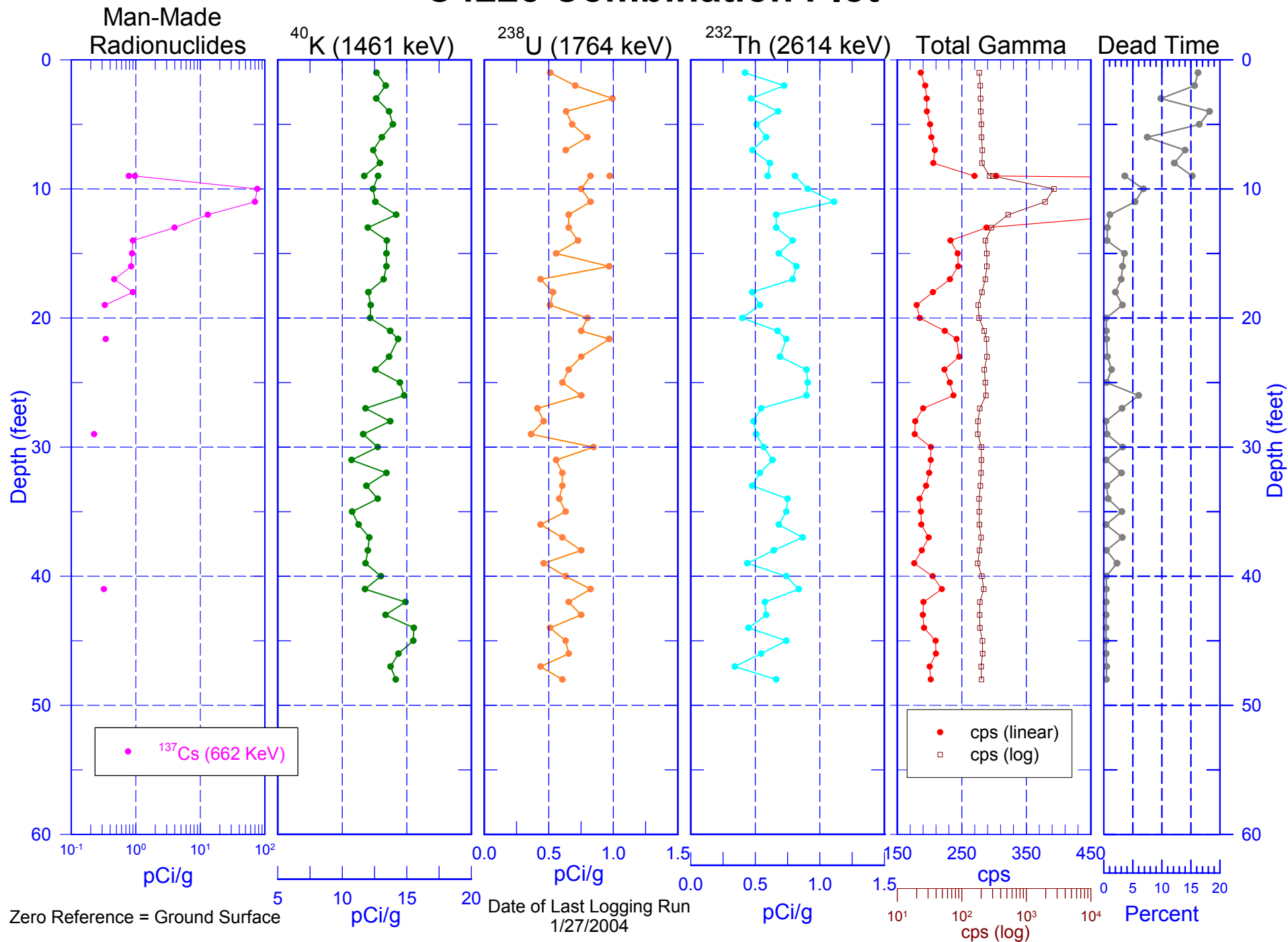
## Natural Gamma Logs



# C4225 Combination Plot

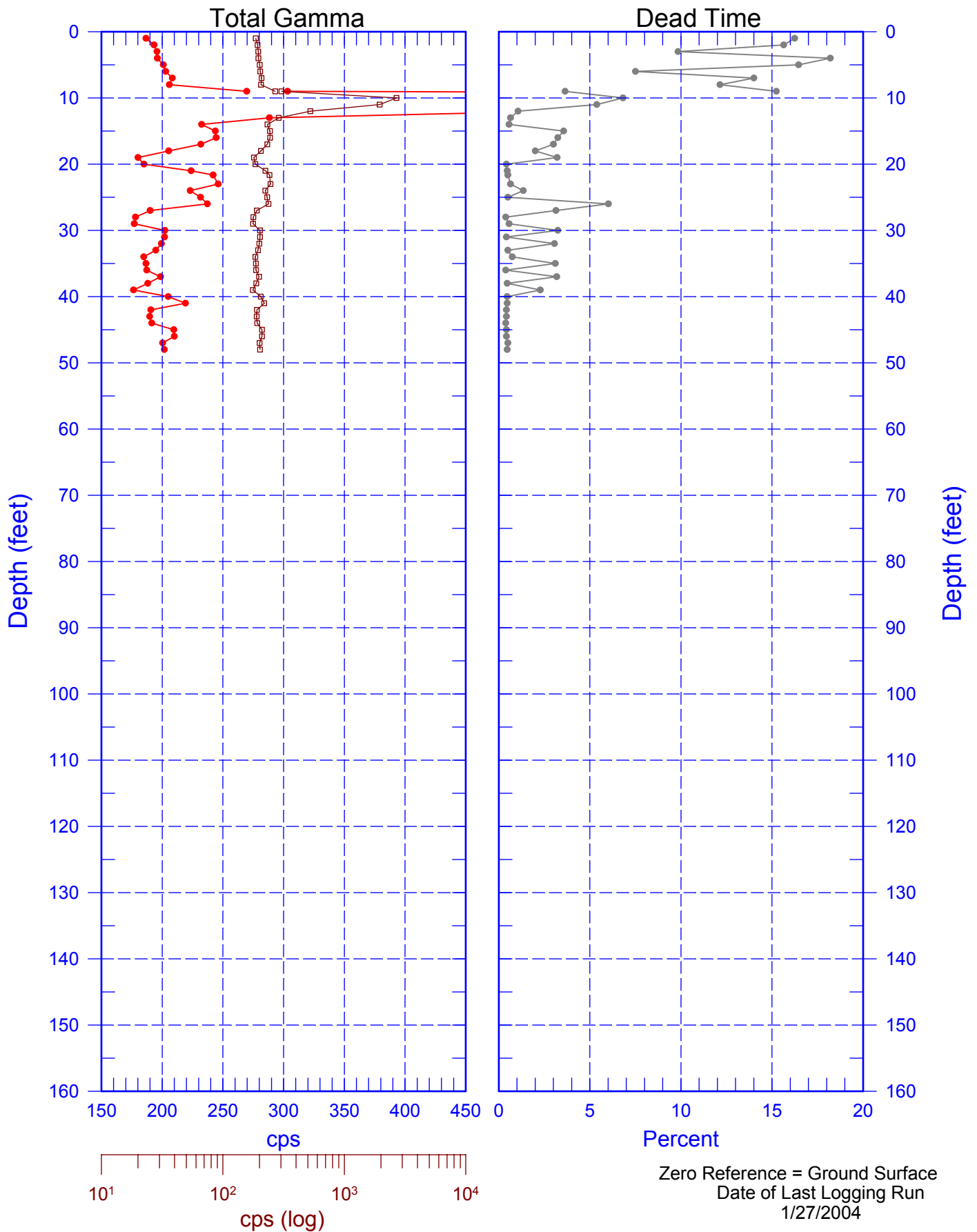


# C4225 Combination Plot



# C4225

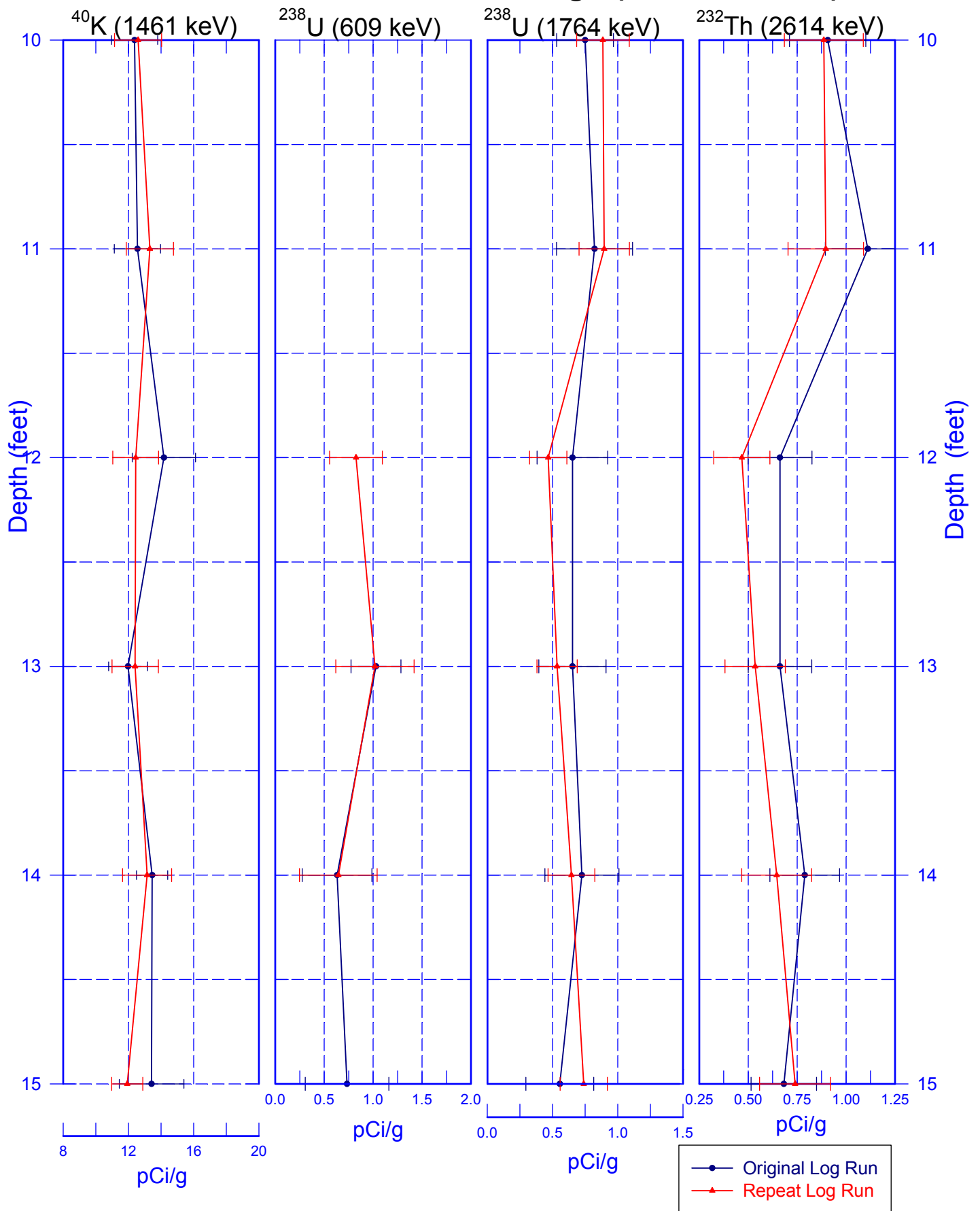
## Total Gamma & Dead Time





# C4225

## Rerun of Natural Gamma Logs (15.0 to 10.0 ft)



# C4225

## Rerun of Man-Made Radionuclides

